



XXVII FIG CONGRESS

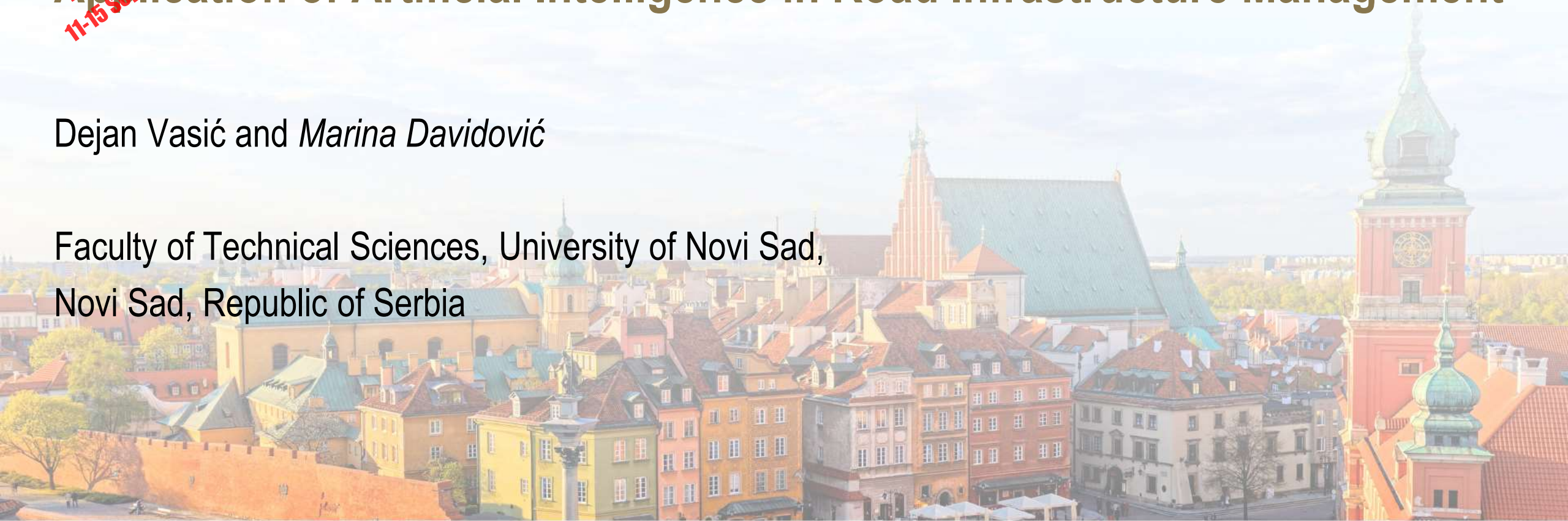
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Volunteering
for the future –
Geospatial excellence
for a better living

Application of Artificial Intelligence in Road Infrastructure Management

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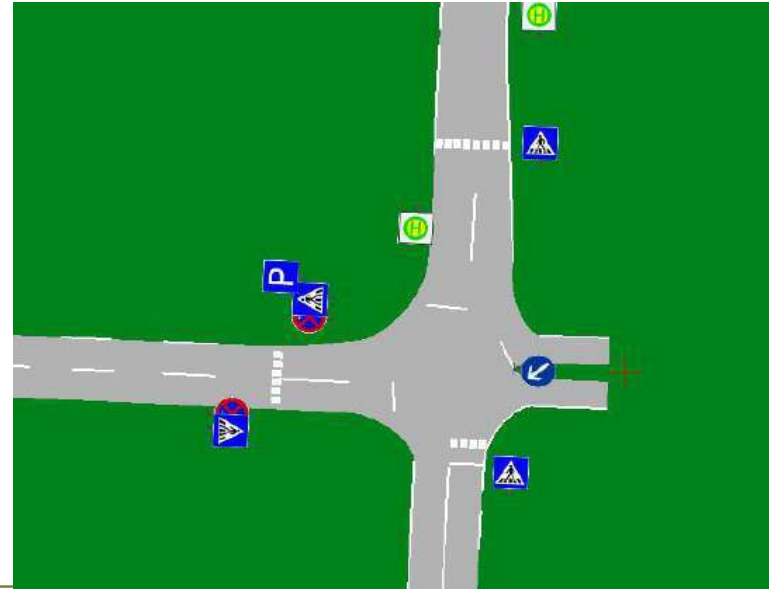
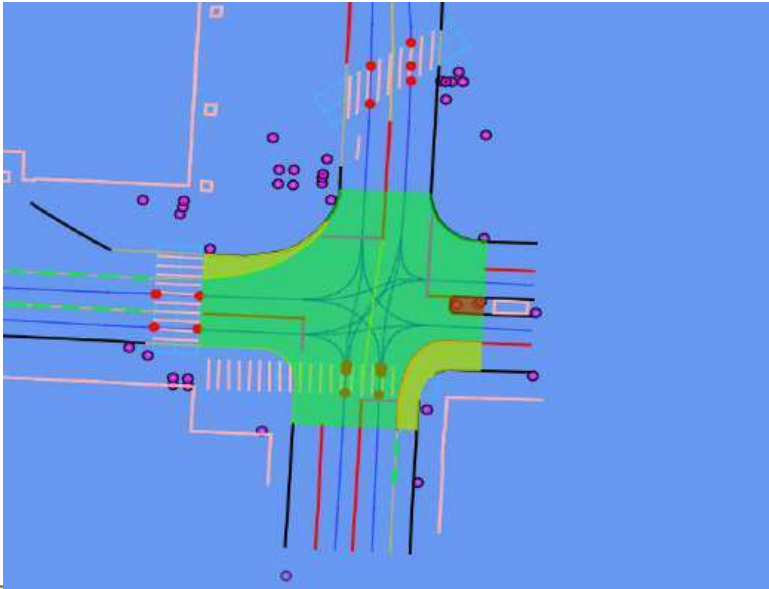


PLATINUM SPONSORS



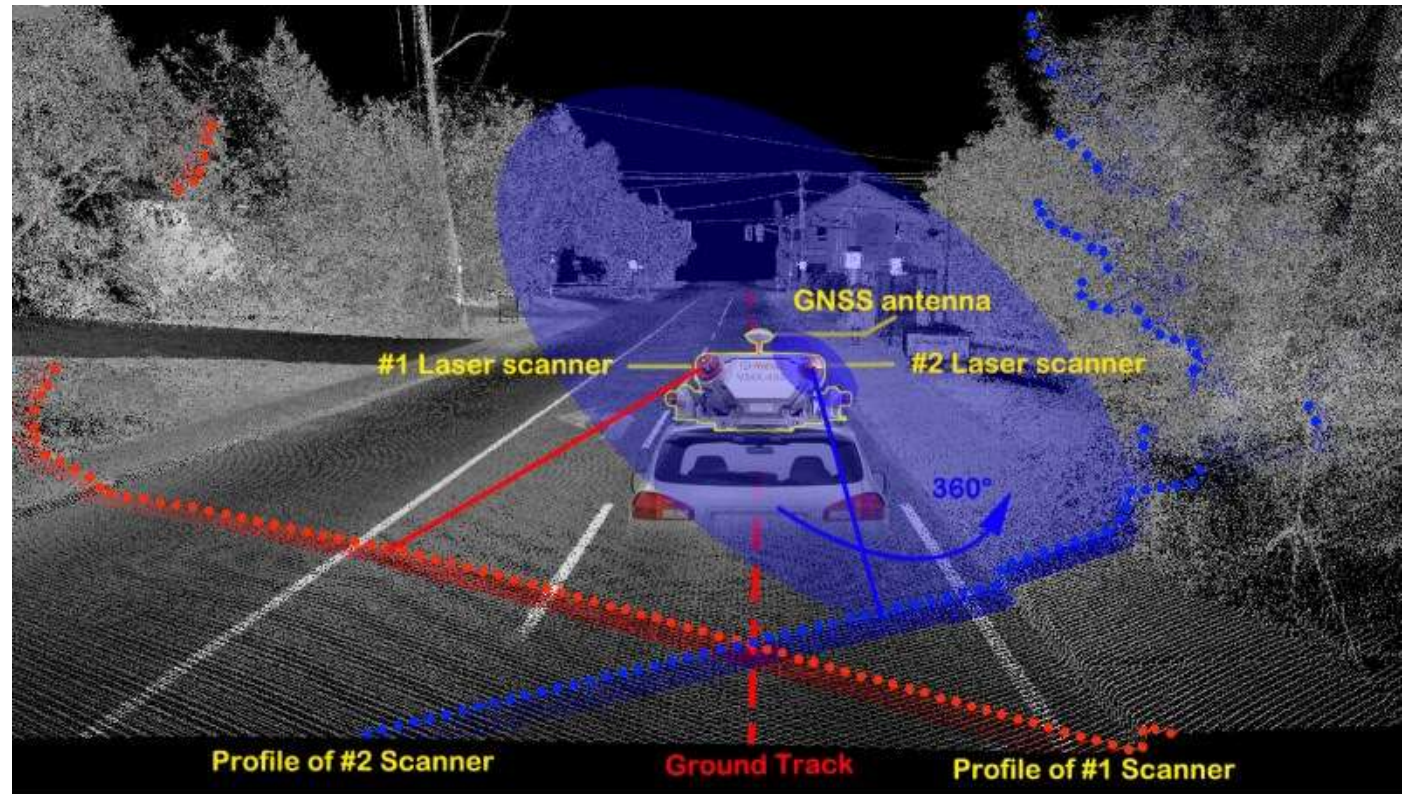
Need for Road Infrastructure Objects Extraction

- In order to better manage the environment, built objects and assess their possible deformations, the collection of 3D spatial data is becoming increasingly important.
- DGM, DTM, navigation maps, traffic management..
- Choice of method

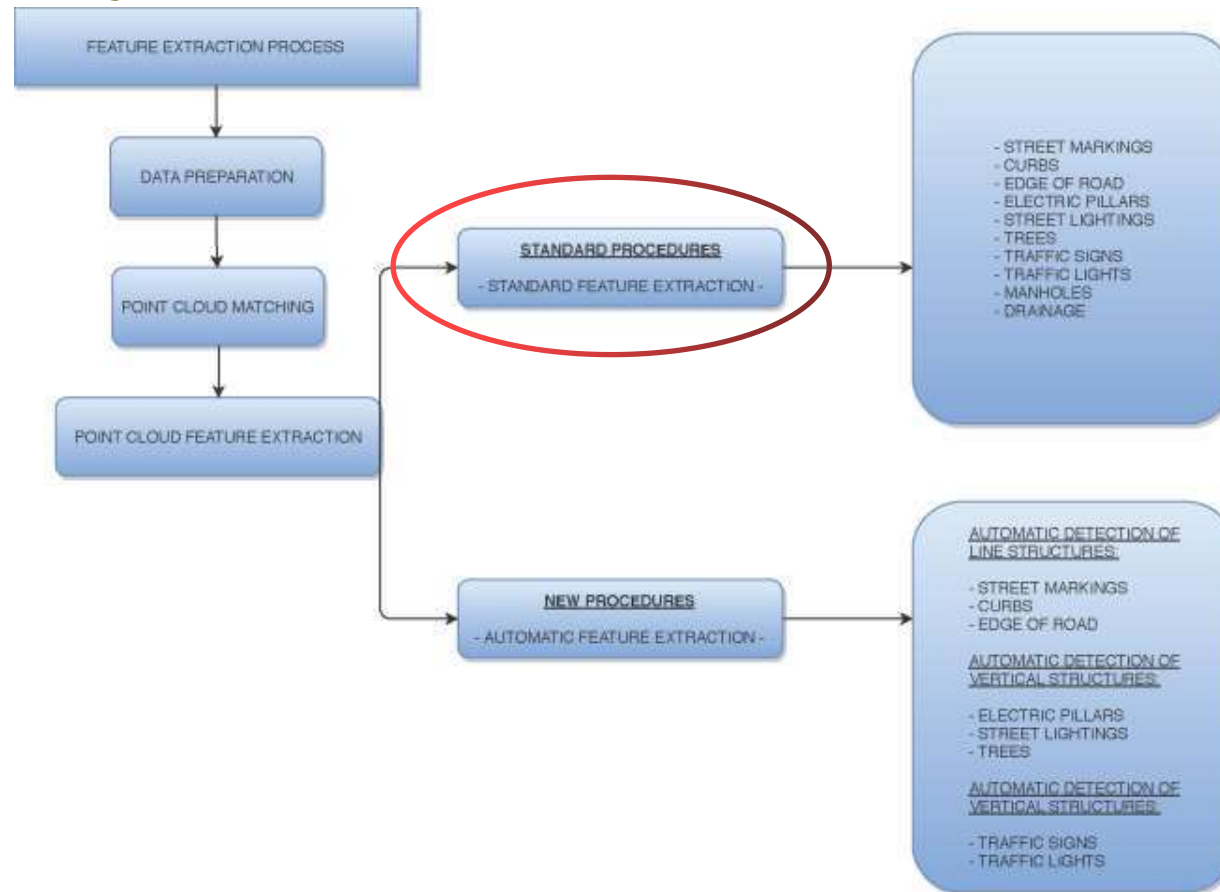


LiDAR Usage in Road Infrastructure Objects Extraction

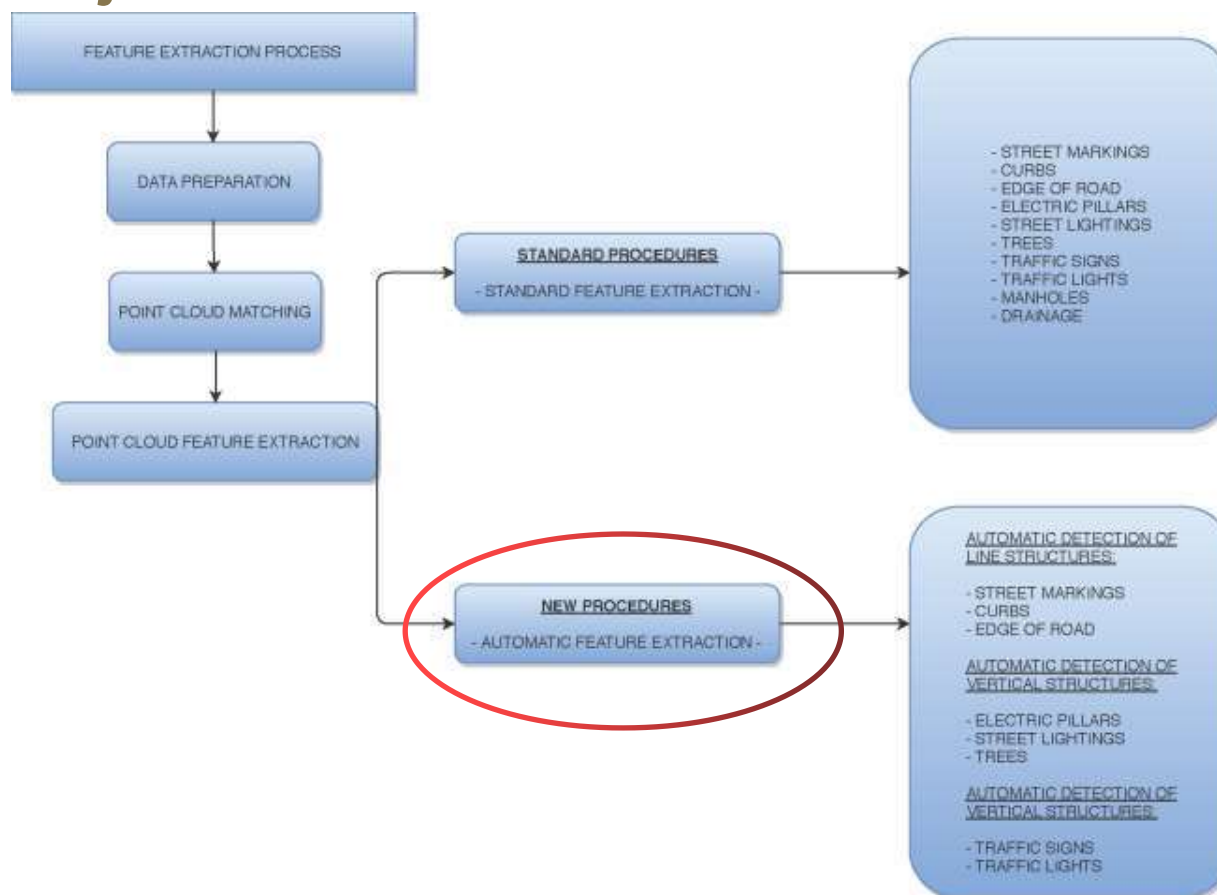
- Active method
- Georeferenced data
- Greater accuracy, precision and density
- High spatial and temporal resolution
- Multiple reflection registration



Road Infrastructure Objects Extraction Procedure - Standard Procedure



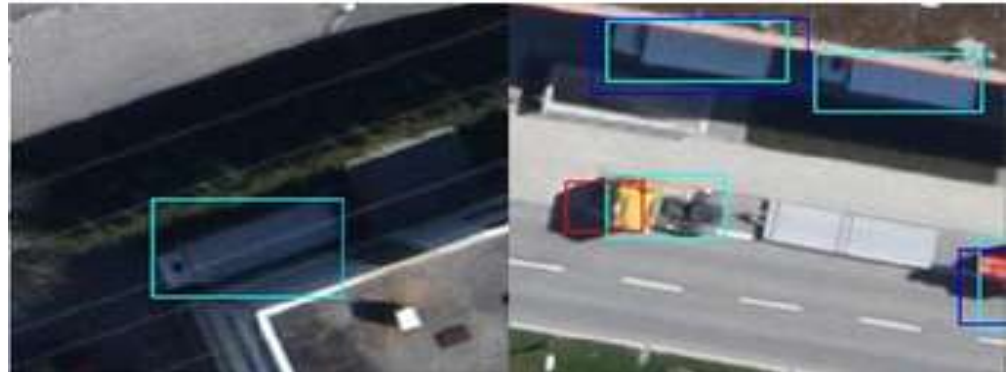
Road Infrastructure Objects Extraction Procedure - AI



AI - Vehicle Detection

Faster R-CNN

- Detected cars (red boxes) and trucks (dark blue boxes) and corresponding ground truth cars (green boxes) and trucks (light blue)



- Detection accuracy can be improved by replacing the network architecture by an architecture especially designed for handling small object sizes.

AI - Vehicle Detection

Pre-trained Faster R-CNN

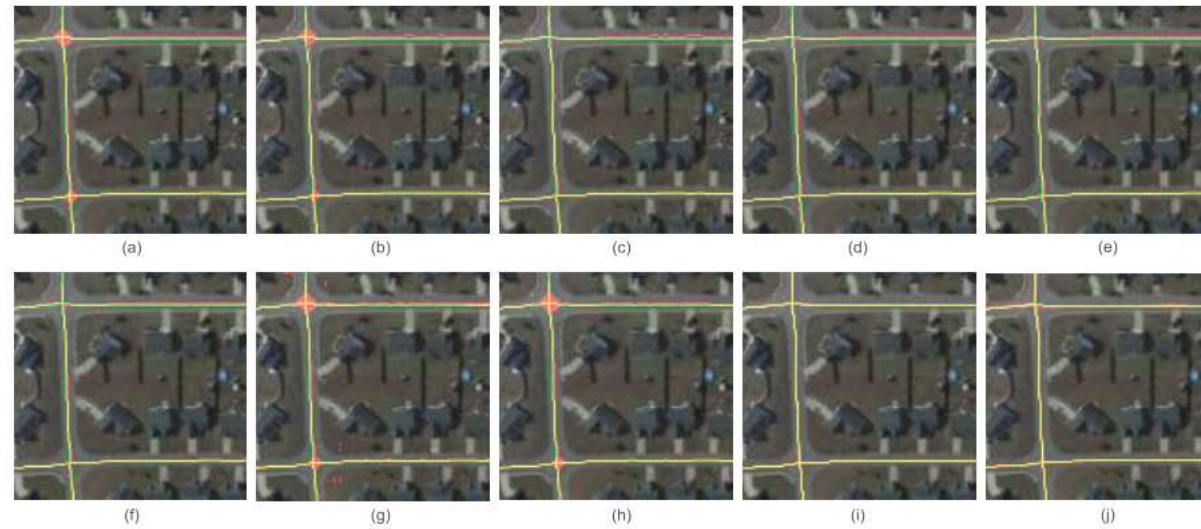


Image	Car present	True Positives	False Positives	Successfully rate
Image 1	61	49	3	80.32%
Image 2	27	20	2	74.07.%

- Some minor deformations were detected in the study area (facade visibility, moving objects and still objects).

AI - Centerline Detection

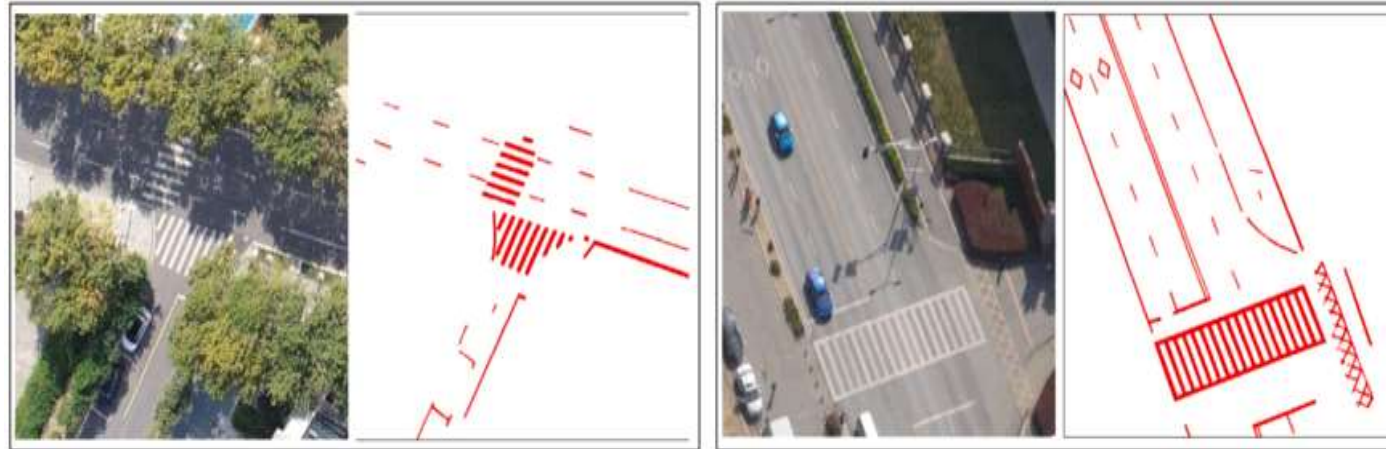
RCNN-UNet



- Road centerline extraction results. Yellow color: true positive parts. Red color: false positive parts. Green color: false negative parts.
- Comparative evaluation with 7 well-known approaches

AI - Road Marking Detection

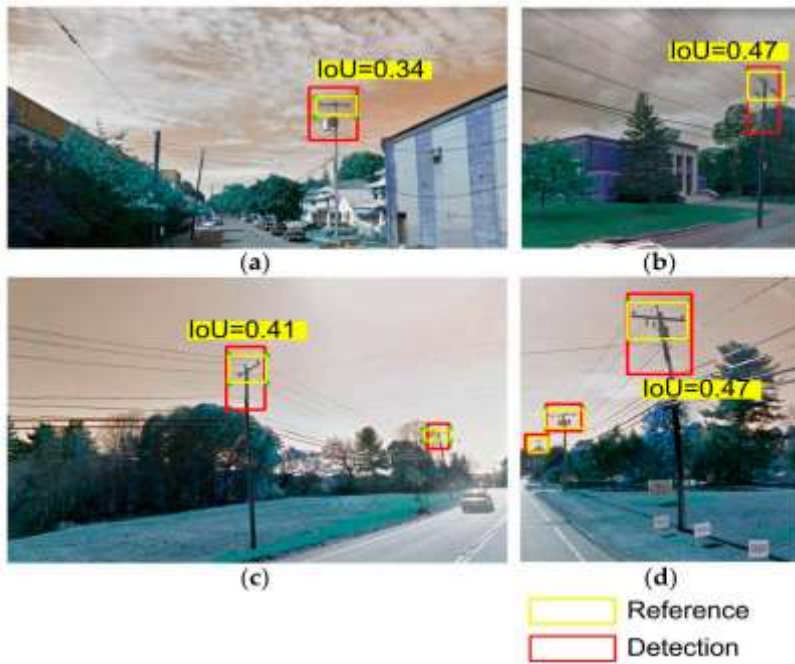
ACapsFPN



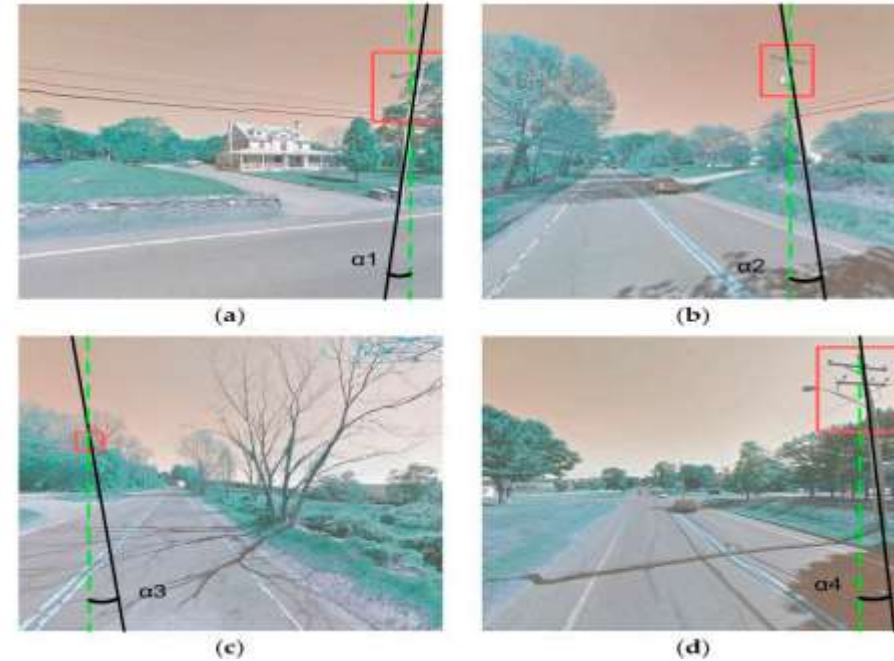
- A close view of the road marking extraction results. Even the successfully rate is satisfying, the road markings occluded by objects, were not continuously delineated due to the fact that road making data did not appear on the images.

AI – Pole-Like Objects Detection

Modified DL Object Detection Algorithm



Positive detected utility poles



Wrongly positioned detected utility poles

Conclusion

This paper presents the use of AI in the detection and extraction of road infrastructure elements, from images obtained by MMS technology. These images consisted of a variety of road elements and a wide range of image scales, resolutions and compositions. Most of the images contain complex backgrounds and occlusions caused by trees or buildings. This made the road identification task extremely challenging.

It is shown that neural networks, such as CNN, significantly improved the detection accuracy compared to traditional approaches. Here are elaborated some newest researches with their results, future work, parameters and usage.

Automated detection of road infrastructure elements has become an increasing necessity for transportation-related activities, including traffic monitoring, automatic vehicle driving, and autonomous navigation. Even mentioned methodologies improved object detection and localization, there is still a lot of space for further development.

Thank You for Your attention!

Questions



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